I claim:

1. A method of reconstructing images from data provided by at least one detector, comprising the steps of:

rotating a scanner in a single curve within a plane about a stationary object while scanning the object;

scanning the object along a line transversal to the plane with the scanner; and

reconstructing an exact image of the scanned object with a convolution based FBP(Filtered Back Projection) algorithm.

2. The method of claim 1, wherein the single curve includes the step of:

rotating a C-arm device about a portion of the object.

3. The method of claim 1, wherein the single curve includes the step of:

rotating a gantry about a portion of the object

4. The method of claim 1, wherein the single curve includes the step of:

rotating between approximately 5 degrees up to approximately 360 degrees.

5. The method of claim 4, further comprising the step of:

rotating over approximately 360 degrees about the object.

6. The method of claim 1, wherein the rotating and the subsequently scanning the object include the steps of:

moving a table supporting the object through a C-arm device and rotating the C-arm around the object.

7. The method of claim 1, wherein the step of reconstructing further includes the step of:shift invariant filtering of the cone beam projections; and

back projection updating the image of the scanned object.

8. The method of claim 1, wherein the step of reconstructing includes the steps of:

storing approximately 2 to approximately 4 cone beam (CB) projections in memory at a time; and

using one family of lines for the step of reconstructing.

9. The method of claim 1, wherein the step of reconstructing includes the steps of:

storing 1 cone beam (CB) projection in memory at a time; and

using one family of lines for the step of reconstructing.

10. A method of reconstructing images from a planar curve scan and a line scan of an object, comprising the steps of:

(a) collecting cone beam (CB) data from a detector during the planar curve scan and the line scan of the object;

(b) identifying lines on a plane Π intersecting the cone beam, wherein the step (b) of identifying lines includes the steps of:

(bi) if the x-ray source belongs to the line scan, project the planar curve scan onto Π and choose a discrete set of lines tangent to that projection;

(bii) if the x-ray source belongs to the planar curve scan, project the planar curve scan onto Π and choose a discrete set of lines parallel to that projection;

(c) preprocessing and shift invariant filtering said data along said lines, wherein the step (c) of preprocessing includes computing the derivative $(\partial/\partial s)D_f(y(s),\Theta)$, wherein

s is parameter along the scan path, which determines point $y(s)$ on the said path,

$D_f(y,\Theta)$ is the cone beam transform of f corresponding to the x-ray source located at the point y and the direction Θ,

f is a function describing the object being scanned;

(d) back projecting said filtered data to form a precursor of said image; and

(e) repeating steps a, b, c, and d until an image of the object is reconstructed.

11. The method of claim 10, wherein shift-invariant filtering in step (c) includes convolving the derivative $(\partial/\partial s)D_f(y(s),\Theta)$ with kernel $1/\sin(\gamma)$ within a filtering plane containing $y(s)$ and a line, identified in step (b) above, where γ is polar angle in the plane.

12. The method of claim 10, wherein the planar curve scan includes:

a complete circle about the object.

13. The method of claim 10, wherein the planar curve scan includes:

less than complete circle about the object.

14. The method of claim 10, wherein the back-projection step (d) includes the steps of:

(di) fix a reconstruction point x, which represents a point inside the object being scanned, to reconstruct the image;

(dii) If s belongs to $I(x)$, then the said filtered CB data affects the image at x and one performs Steps (diii) to (dvii). If s is not inside the interval $I(x)$, then the said filtered CB data is not used for the image reconstruction at x and go back to step (di) and choose another reconstruction point, here

$I(x)$ is the parametric interval corresponding to the section of the scan path bounded by the PI-line of x;

PI-line of x is the line segment containing x, one endpoint of which belongs to the planar curve scan, and the other endpoint of which belongs to the line scan;

(diii) find the projection $\hat{x}$ of x onto a detector plane $DP(s)$ and unit vector $\beta(s,x)$, which points from $y(s)$ towards x;

(div) estimate a value of $\Phi(s,\beta(s,x))$, where $\Phi(s,\beta(s,x))$ is the filtered CB data corresponding to the source position located at the point $y(s)$ and direction $\beta(s,x)$;

(dv) determine contribution from filtered CB data to the image being reconstructed at the point x by multiplying $\Phi(s,\beta(s,x))$ by a weighting factor;

(dvi) add the said contribution to the image being reconstructed at the point x according to a pre-selected scheme; and

(dvii) go to step (di) and choose a different reconstruction point x.

15. The method of claim 10, further comprising the steps of:

storing approximately 2 to approximately 4 cone beam (CB) projections in memory at a time; and

using one family of lines for each x-ray source position for the step of filtering.

16. A method of computing images derived from a planar curve scan and a line scan, comprising the steps of:

(a) collecting cone beam (CB) data from a detector during a planar curve scan and line scan of an object;

(b) identifying lines on a plane Π intersecting the cone beam, wherein the step (b) of identifying lines includes the steps of:

(bi) if the x-ray source belongs to the line portion of the scan, project the planar curve portion of the scan onto Π and choose a set of lines tangent to that projection;

(bii) if the x-ray source belongs to the planar curve portion of the scan, project the planar curve portion of the scan onto Π and choose a set of lines parallel to that projection;

(c) preprocessing and shift invariant filtering said data along said lines, wherein the step (c) of preprocessing includes computing the derivative of $D_f(y(s),\Theta)$

with respect to Θ along a direction non-parallel to the plane determined by $y(s)$ and a filtering line, the said plane being a filtering plane, here

s is parameter along the scan path, which determines point $y(s)$ on the said path,

$D_f(y,\Theta)$ is the cone beam transform of f corresponding to the x-ray source located at the point y and the direction Θ,

f is a function describing the object being scanned;

(d) back projecting said filtered data to form a precursor of said image; and

(e) repeating steps a, b, c, and d until an image of the object is reconstructed.

17. The method of claim 16, wherein shift-invariant filtering in step (c) includes convolving the data $D_f(y(s),\Theta)$ with kernel $1/\sin(\gamma)$ within a filtering plane, where γ is polar angle in the plane.

18. The method of claim 16, wherein shift-invariant filtering in step (c) includes convolving the data $D_f(y(s),\Theta)$ with kernel $\frac{\partial}{\partial\gamma}\frac{1}{\sin(\gamma)}$ within a filtering plane, where γ is polar angle in the plane.

19. The method of claim 16, wherein shift-invariant filtering in step (c) includes convolving the derivative of $D_f(y(s),\Theta)$ with a kernel within a filtering plane, the derivative of $D_f(y(s),\Theta)$ is the derivative with respect to Θ along a direction non-parallel to the filtering plane.

20. The method of claim 19, wherein $y(s)$ belongs to the line portion of the scan.

21. The method of claim 19, wherein $y(s)$ belongs to the planar curve portion of the scan.

22. The method of claim 16, wherein the planar curve scan includes:

a complete circle about the object.

23. The method of claim 16, wherein the planar curve scan includes:

less than complete circle about the object.

24. The method of claim 16, wherein the back-projection step (d) includes the steps of:

(di) fix a reconstruction point x, which represents a point inside the object being scanned, to reconstruct the image;

(dii) If s belongs to $I(x)$, then the said filtered CB data affects the image at x and one performs Steps (diii) to (dvii). If s is not inside the interval $I(x)$, then the said filtered CB data is not used for the image reconstruction at x and go back to step (di) and choose another reconstruction point, wherein

$I(x)$ the parametric interval corresponding to the section of the scan path bounded by the PI-line of x;

PI-line of x is the line segment containing x, one endpoint of which belongs to the planar curve scan, and the other endpoint of which belongs to the line scan;

(diii) find the projection $\hat{x}$ of x onto a detector plane $DP(s)$ and unit vector $\dot{\beta}(s,x)$, which points from $y(s)$ towards x;

(div) estimate a value of $\Phi(s,\beta(s,x))$, where $\Phi(s,\beta(s,x))$ is the filtered CB data corresponding to the source position located at the point $y(s)$ and direction $\beta(s,x)$;

(dv) determine contribution from filtered CB data to the image being reconstructed at the point x by multiplying $\Phi(s,\beta(s,x))$ by a weighting factor;

(dvi) add the said contribution to the image being reconstructed at the point x according to a pre-selected scheme; and

(dvii) go to step (di) and choose a different reconstruction point x.

25. The method of claim 16, further comprising the steps of:

storing 1 cone beam(CB) projection in memory at a time; and

using one family of lines for each x-ray source position for the step of filtering.

26. A method of reconstructing images from data provided by at least one detector, comprising the steps of:

scanning the object with a planar curved scan and a line scan by at least one detector; and

reconstructing an exact image of the scanned object with a convolution based FBP(Filtered Back Projection) algorithm.

27. The method of claim 26, wherein the scanning step includes the step of: scanning by the planar curved scan before the line scan.

28. The method of claim 26, wherein the scanning step includes the step of: scanning by the line scan before the planar curved scan.

29. The method of claim 26, further comprising the step of: providing a C-arm device for the scanning of the object.

30. The method of claim 26, further comprising the step of: providing a gantry for the scanning of the object.

31. The method of claim 26, wherein the planar curve scan includes: at least a full circle scan about the object.

32. The method of claim 26, wherein the planar curve scan includes: less than a full circle scan about the object.

33 ~~32.~~ The method of claim 26, further comprising the step of: consecutively scanning the object with another planar curve scan and another line scan.